

SURGERY IN THE PRESENCE OF SUGAR IN THE URINE.¹

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THE great improvement in the perfection of surgical technique in the last decade has compelled a reconsideration of former surgical traditions, among which is the "*noli me tangere*" of those individuals who, suffering with surgical diseases, are so unfortunate as to have glycosuria too. The opinion is growing, that, while such individuals are not good surgical subjects, nevertheless, with extreme care in the selection of cases and scrupulous perfection in surgical asepsis, they must not be denied the benefits of surgical relief.

Godlee, in the *Medico-Chirurgical Transactions*, 1893, thinks the advance of modern surgery should make us reconsider our position with regard to the treatment of the several forms of gangrene which occur in those suffering with diabetes mellitus. The cases which are presented in this paper illustrate some of the questions which the surgeon has to meet in reaching a decision as to when it is wise to attempt the risk of relief and when not.

CASE I.—*Diabetes Mellitus; Carcinoma of the Breast; Halsted's Operation; Recovery.* T. Mc., a widow of sixty-one years, consulted me in August of 1895 for a tumor of the right breast. She was a short, thick-set, fleshy woman, with a feeble circulation and fatty heart. In the right breast there was a hard, nodular mass about four inches in diameter in the upper and inner quadrant. The skin

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over this was ulcerated for an area of two by two and one-half inches. The breast was freely movable upon the pectoral muscles beneath, and no glands could be felt in the axilla or above the clavicle.

Examination of the urine showed the existence of 2.5 per cent. of sugar, and careful inquiry disclosed that for some time there had been the usual symptoms of diabetes. Two days after she entered my service, without any preliminary antidiabetic treatment, ether was administered, and the entire breast, pectoralis major and minor, with axillary fat and glands, *en masse*, was excised. Recovery was good, and union was by first intention, excepting for a small area, where the skin could not be brought together. Two weeks from the day of operation this area was covered with Thiersch's skin-graft under primary anæsthesia. She left the hospital, cured. On March 25, 1898, nearly two and one-half years afterward she came to me because of a slight recurrence in the cicatrix, which was removed under cocaine. The wound healed well then. The urine showed the presence of sugar by Fehling's test. In November of 1898 she again came to me because of a small ulcer, one-half by three-quarters of an inch, which she attributed to a bruise, over the lower portion of the cicatrix. This was excised, under ether, and a portion of the rib beneath removed. She left the hospital with a granulating wound. At that time there was 2.2 per cent. of sugar in the urine. She was living, to my knowledge, last August, 1899, fully four years from the time of the first operation.

The questions which arose in this case were whether an operation was justifiable in a woman of her age, physique, and enfeebled circulation or not. If so, even with sugar present in the urine in so large a percentage, would it still be justifiable? The decision to operate was based upon the moral effect of the cancer upon the woman; its rapid growth; its ulcerated condition, which must eventually result in sepsis and speedy death; and also that the duration of carcinoma is short in comparison with diabetes, which may run for ten years. Certainly the case was a favorable one for operation, barring the sugar. The risk was taken, and the end justified it.

Landau says that in cases of cancer which admit of operation we have to remember that the diabetes may last for ten years or even more in old or stout people; but, on the other hand, carcinoma usually leads rapidly to death. Therefore, we

ought not to be frightened at energetic measures. There is no doubt that the danger is greater in diabetes, but where there is everything to lose one must dare much.

CASE II.—*Diabetes Mellitus; Acute Suppurative Appendicitis; Operation; Recovery.* Mr. P., a man fifty years of age, on March 7, 1895, was taken suddenly with an acute attack of appendicitis. The following day symptoms of perforation occurred, and on the second day from the onset, at 3 P.M., he was seen by Dr. Abbe. The temperature was 102° F., and pulse 100. The abdomen was distended, tympanitic, and rigid, and there was a distinct tumor in the right iliac fossa. The physician said that sugar had been present in the urine for several years. An operation was decided upon, ether given, the abscess evacuated, and appendix excised. The patient made an excellent convalescence, and the wound healed slowly by granulation. He was living last summer, and engaged actively in business.

This is an instance of an acute surgical disease coming on in a man who had had diabetes for several years. Without the diabetic complication, the man was such—very stout and fleshy—that the surgeon hesitated to operate upon, but with the diabetes the hesitation was even greater. Without operation there was, without question, but one outcome, and that a speedy one. The risk of an operation seemed less, all things considered, than not, because if he did not run into a general peritonitis, he would surely become septic, a very serious consideration. By an operation the septic focus could be removed, and place him in a much more advantageous position to recover. The outcome demonstrated the wisdom of the decision.

CASE III.—*Diabetic Gangrene of Right Foot; Amputation at Middle of Thigh; Recovery.* R. M. D., a man of seventy-five, had had for years varicose veins. In the winter of 1893 he entered St. Luke's Hospital to have them operated upon, but because of the presence of glycosuria the surgeon refused to operate. In November, 1895, the great toe of the right foot began to turn dusky, then purple, finally becoming exceedingly painful and tender. Some weeks later the inflammation extended into the foot. On January 1, 1896, he entered my service at Trinity Hospital. The temperature was 101.4° F.; pulse, 110; respiration, 27. The large toe was gangrenous, and the inflammation ran up into the sole of the foot.

Examination of the urine by Dr. E. K. Dunham discovered 7.5 per cent. of sugar. This was two days before the operation. On January 8, 1896, the leg was amputated at the middle of the thigh by short anterior and posterior flaps, which were loosely caught together. Esmarch's tourniquet was used. The femoral was patent above the site of amputation, but was atheromatous. Union was by first intention, except the drainage sinus, which persisted. The patient made an excellent recovery, and was discharged cured. The examination of the urine for some months after is of much interest, showing the gradual diminution in the quantity of sugar, with its final disappearance.

On January	6	there was	7.5	per cent. ¹
January	13	"	2.5	" "
January	18	"	1.5	" "
January	22	"	1.5	" "
January	30	"	0.48	" "
February	8	"	0.67	" "
February	28	"	1.67	" "
March	11	"	0.42	" "
March	28	"	0	" "
April	15	"	0	" "
May	4	"	0	" "

All of these examinations were made by Dr. Dunham. It is especially interesting to notice the five per cent. decline in the quantity of sugar present in the urine within five days after the removal of the gangrenous foot, with the gradual disappearance of this as the process of healing advanced.

König (*Berliner klinische Wochenschrift*, 1890-91) calls attention to similar incidents in two cases of gangrene occurring in diabetics, in which, after failure by dietetic treatment to reduce the percentage of sugar, amputation was performed, with prompt recovery from the operation, and the subsequent disappearance of the sugar from the urine.

The subsequent history of my patient is interesting. In November, 1896, he entered the New York Hospital because of gangrene of the left foot of the great and adjoining toes, with the inflammation extending well into the sole of the foot. The urine at this time was yellow, acid, 1022, with a trace of albumin but without sugar. On

¹ This was two days before operation, which was January 8, 1896.

November 19 ether was given, Esmarch's bandage put on, and the leg amputated at the thigh by long anterior and posterior flaps. The anterior flap went as low as the middle of the patella; the posterior was one and one-half inch shorter. The femoral artery was found very calcareous.

Urine examinations: November 23, clear; 1024; albumin, slight trace; no sugar. November 28, 1028; albumin, slight trace; no sugar. On December 2, sloughing of the flaps occurred, and two days later the man died.

The entire absence of glycosuria in the subsequent history of this man, and the noticeable change in the femoral artery, indicates the very important etiological part that arteriosclerosis has in diabetic gangrene. At the time of the first operation 7.5 per cent. of sugar was present, but at the second there was none.

CASE IV.—*Diabetes Mellitus; Gangrene, Second Toe Right Foot; Amputation; Subsequent Gangrene of Left Foot, Spreading Rapidly; Death.* J. G., man of sixty. In March, 1896, in getting out of bed bruised the second toe of the right foot; then he pulled off some of the skin; later it became inflamed and was incised by his physician. This was followed by sloughing and necrosis of the last phalanx. Sugar was present in the urine to 1 per cent. When I saw the patient there was sloughing of the skin on the dorsal surface of the terminal phalanx, with protrusion of the proximal phalanx through a sloughing area on the upper surface. And there was tenderness with a slight blush running upon the dorsum of the foot. Amputation above the condyles of the femur was advised but declined. Amputation of the toe was requested, although the risks and probable outcome were fully explained, and that nothing would be gained by the procedure. This was done under protest; the resulting wound was exceedingly sluggish, showing no tendency to heal, but no extension of the process took place into the foot. Gangrene of the left foot came on suddenly, which extended so rapidly that within four days the man died in a comatose state.

In considering the question of operative measures in those having sugar in their urine, opinions differ decidedly regarding the necessity of distinguishing between those in whom this

condition is transitory (glycosuria) and those in whom it is intermittent or persistent. So exceedingly difficult is it to determine this fact, that many surgeons discard any attempt to do so. Verneuil before the Société de Chirur. of Paris in 1884 said, "I hardly admit the separation, no one having so far shown me clearly where glycosuria ends and where diabetes begins. To-day in the possession of more facts, I have decided to discard absolutely, as a surgeon, at all events, the existence of an arbitrary division, which does not present, in my opinion, any practical utility. From the surgical point of view, the presence of glucose in the urine, whatever its amount, is always a serious fact.

Godlee (*Medico-Chirurgical Transactions*, 1895) writes, "I doubt the possibility of distinguishing between these conditions, and from the surgeon's point of view of the necessity of attempting to do so." Tuffier thinks that the simple presence of glucose in the urine is sufficient to provoke grave symptoms. But Smith and Durham (*Guy's Hospital Reports*, 1892), while they admit that there is great difficulty in making a distinction between glycosuria and diabetes mellitus, and although various attempts have failed to establish this difference, nevertheless, insist upon the importance of some distinction because of the more favorable prognosis.

They insist that glycosuria, with or without polyuria and albuminuria, may and frequently does occur as the result of the surgical lesion for which the patient presents himself. Consequently, by its presence it may lead to a possible erroneous diagnosis of a past glycosuric state and therefore influence the prognosis. They make, therefore, this classification:

- I. Those cases in which the lesion demanding surgical aid is the actual and direct cause of the appearance of sugar in the urine, which comprises those varieties in which the excretion of sugar is determined by the influence of micro-organisms,—i.e., the septic variety, which is usually the *staphylococcus pyogenes aureus*; those in which it results from the use of such drugs as chloroform, chloral and opium, and, finally, those in which it follows upon some mechanical injury, as a blow upon the head or abdomen.

F. König (*Berliner Klinische Wochenschrift*, 1896) supports this view. He says, "The French have shown that often in connection with some infection a greater or less amount of sugar may appear in the urine, disappearing again after proper surgical treatment of the infection, so that not all cases of glycosuria with infection are diabetic. The appearance of sugar in these cases is generally of short duration, lasting either a few hours or days, but rarely persisting. The sugar in many cases appears on a rise of temperature, and it follows upon the rise and is not the cause of this."

The second division of this classification is:

II. Those cases in which the sugar in the urine precedes, and is not dependent upon the surgical lesion; the lesion and the glycosuria are independent conditions, or the lesion is dependent on some previous glycosuric condition,—*e.g.*, gangrene.

The conclusions which they deduct are that—

(1) Sugar is very common in appreciable amounts as the result of toxic and traumatic lesions.

(2) There is no evidence to prove, and no reason to suppose, that as the result of this secondary glycosuric condition either the lesions themselves or the operations for those lesions are rendered more severe.

(3) . . . The previously diabetic are liable to various complications; therefore we must not, on discovering sugar in the urine, condemn a patient as liable to these complications till a full inquiry has been made into the past history and present condition.

(4) We think, therefore, that we are justified in separating, as far as possible, those cases where the sugar is the result of the lesion for which the patient is seeking advice from those where the lesion occurs in a patient previously glycosuric.

(5) There is no reason to suppose, as many following Verneuil do, that the presence of sugar in the urine necessarily implies a more guarded prognosis.

(6) On discovering sugar in the urine, if this be found to be secondary to the lesion demanding operative treatment, and not to a previously glycosuric habit, there is no contraindica-

tion to operation; and there is no evidence to show that the results will be any worse than in non-glycosuric patients.

With regard to those individuals who have sugar intermittently or persistently in their urine,—the diabetics,—Lancereaux recognizes three clinical varieties, the lean, the fat, and the traumatic.

The greatest number of cases of diabetics which come under the care of the surgeon are of the fat variety, the first three of my cases being of this class. What is of especial interest is, that the lean and traumatic varieties appear to have but little disposition to septic infection, which is thought to be due to their rapid evolution, in consequence of which tissue changes have not had time to assume the importance which they ultimately adopt in the other variety.

Smith and Durham consider operative measures upon diabetics: first, those that are urgent, *e.g.*, strangulated hernia, injuries, acute appendicitis; and, secondly, those that are not of immediate necessity, which include all that would, under ordinary circumstances, be performed. The general rules to follow in all these cases is to perform that operation which involves the least disturbance of the parts, and entails the least shock.

In deciding this question the surgeon must take into consideration the duration of the disease, the quantity of sugar, the degree of cachexia, and the results of antidiabetic treatment.

Tuffier believes that if medical treatment does not diminish the quantity of sugar, *no* operation should be performed. König's experience is opposed to this in the cases cited; and Smith and Durham have not been lead to such a conclusion. They found that in many cases where the sugar disappeared from the urine, death resulted, but in many others, when it persisted, recovery occurred.

Durham writes that he has operated upon diabetic patients in a considerable number of cases of very various nature,—from the removal of a nasal polypus to the performance of amputation through the thigh,—and that as the result of his experience he does not consider the existence of diabetes to be

seriously deterrent to operative measures, in cases in which, on general grounds, such measures are called for. The cases as a rule did well, although healing was delayed, especially when union by granulation took place. It is their opinion that there is no evidence that diabetes *per se* will lead to suppuration, but that the inflammatory troubles are due to the conveyance of micro-organisms from without. In the gangrenous affections of the fingers and toes in diabetic people, the etiological factors are supposed to be traumatisms of very insignificant extent, arteriosclerosis and nerve-degeneration. Roser thought that the diabetes was the actual cause, but he was unable to substantiate this. Israel attributes spontaneous gangrene to (1) an imperfect access of normal blood to the affected parts, (2) perfect access of abnormal blood, and (3) imperfect access of abnormal blood. The first embraces cases of senile gangrene due to arteriosclerosis; the second, gangrene following infectious diseases, and the third, diabetic gangrene.

Out of twenty diabetics who consulted him, no less than thirteen had arteriosclerosis. Smith and Durham collected sixty-three cases, in twenty-four of which the condition of the arteries was noted, and arteriosclerosis existed in all. Lancercaux considers the arteriosclerosis a most important factor, and Heidenheim states that clinically there is a great resemblance between diabetic and senile gangrene, and that arteriosclerosis is frequently associated with the former. In fact, so firmly is the opinion established of the etiological importance of these arterial changes in the production of diabetic gangrene, that the same operative measures must be followed in this as in senile gangrene. Mr. Jonathan Hutchinson in 1883 called attention to the necessity, in all cases of senile gangrene, of amputating high up, and he supported his opinion by five cases. This opinion has been more firmly established by Heidenheim's series from Kuster's clinic, which was published in 1891. Kuster began with low amputations, but was obliged to re-amputate higher up, because of gangrene of the wound. In every case of gangrene of the lower extremity, in which the process had extended to the dorsum or sole of the foot, he was compelled to amputate through or above the knee. This series

comprises twenty-five cases, eleven with diabetes, fourteen with simple arteriosclerosis.

Of thirteen cases in which amputation was performed below the knee, including Chopart's and Lisfranc's operations, two healed, two died of gangrene of the flaps, and nine were re-amputated.

Of seventeen primary amputations through or above the knee, two healed by first intention, three after marginal flap gangrene, three after re-amputation, and eight died.

Of ten secondary amputations through or above the knee, three healed by first intention, six after marginal gangrene, and one after re-amputation.

G. B. Smith, in order to compare the different methods of treatment adopted in diabetic and senile gangrene, collected all of the cases which had been admitted to the Surgical Wards of Guy's Hospital since 1879, to the number of forty-eight, which he classified according to their treatment under the following heads :

- (1) Local expectant antiseptic treatment.
- (2) The removal of the dead structures with the cutting through of the tendinous and fascial structures.
- (3) Amputations close to the gangrenous area,—*i. e.*, low amputations.
- (4) High amputations :
 - (a) Those carried out below the knee.
 - (b) Those performed through or above the knee-joint.

Of twelve cases treated expectantly, one recovered, three remained in *statu quo*, two were in the process of healing, one was relieved, and five died.

The cases of this class were those in which an operation was inadvisable, because of the general condition of the patient and, also, those cases in which the gangrene was limited generally to one or two toes or a patch of skin, without any symptoms of general septic poisoning. Heidenheim limits the expectant treatment to those cases in which two or three toes only are affected.

Of eleven cases in which the operation was limited to the division of the tendons and fascia in the removal of the dead

parts, or to incision of abscesses either in the dorsum or sole of the foot, every one died.

"This disturbance, however slight, of the parts seems sufficient to open up channels through which infection of the adjoining parts takes place." Heidenheim is strong in his denunciation of this procedure.

Of nine cases in which amputation was done close to the gangrenous area, two recovered after periods of eleven weeks and twenty weeks, two were convalescing—one of these after two re-amputations, Lisfranc's, and through the thigh—and five died.

"Although cases of recovery do occur after removal just above the sphacelated portion, healing is very slow; and from the results, one seems hardly justified in exposing the patient to the real and great risks that exist of secondary infection of the wound. The vitality of the parts, is so small that their resistance to invasion by micro-organisms is of the lowest degree."

Of six cases of amputation through the leg, one only recovered. Death occurred with gangrene of the flaps in the remainder. This accords with Kuster's experience.

Of eighteen cases of amputation through the thigh, ten recovered, eight died; four of the eighteen cases had diabetes mellitus, and of these, three died. It appears, therefore, from this review of opinions and my own limited observations, that the presence of glycosuria in those individuals who may have surgical diseases does not in itself constitute an absolute contraindication to any and all surgical relief. Very great judgment must be exercised in the selection of cases, in the determination of the kind and extent of the operation to be performed, and the strictest surgical asepsis must be rigidly observed throughout. Infection when it occurs is from without, and is the result of an error in the technique; it thus happens the constitutional symptoms become most serious, and out of all proportion to the local, generally ending in death. When infection does not occur the operative wounds heal kindly but slowly, especially in granulating wounds. The vascularity of the tissue must be interfered with as little

as possible, so that every operation should be planned with this object in mind. This is particularly so in gangrene of the extremities, in which the statistics of Heidenheim, Kuster, and Smith and Durham show most conclusively the necessity of high amputations in these conditions. I am of the opinion that it is better to cut down upon and ligate the artery in gangrene of the extremities rather than to attempt the bloodless amputation by means of the Esmarch band, in consequence of the possible harm to the tissues, especially the bloodvessels, whose vitality is not of the best.